

WHAT IS CLAIMED IS:

1. A liquid crystal display element comprising:
a liquid crystal layer;
a pixel electrode portion having a plurality of pixel apertures for transmitting light; and

at least one microlens array having a plurality of microlenses arranged in a two-dimensional form on at least one of a light incident side and a light emergent side of said liquid crystal layer corresponding to said pixel apertures,

wherein each of said microlenses comprises:

a light-collecting lens having at least one lens surface in the optical axis direction for collecting incident light toward corresponding one of said pixel apertures; and

a field lens having at least one lens surface in the optical axis direction so that the focal position thereof substantially coincides with the principal point of said light-collecting lens.

2. A liquid crystal display element according to Claim 1, wherein the focal position of the entirety of each of said microlenses substantially coincides with said corresponding pixel aperture.

10045225-14001

3. A liquid crystal display element according to Claim 1, wherein, when incident light having a divergence angle component with respect to the optical axis emerges from said microlens array, the divergence angle component is removed by the optical action of said field lens, and the emergent angle of the incident light substantially coincides with the emergent angle of a principal ray which enters in parallel with the optical axis.

4. A liquid crystal display element according to Claim 1, wherein said liquid crystal display element is applied to a projection type liquid crystal display device which projects light transmitted through said liquid crystal display element via a projection lens, and the numerical aperture of each of said microlens substantially coincides with the F-number of said projection lens.

5. A liquid crystal display element according to Claim 1, wherein each of said microlenses is formed of one or more of a spherical surface, an aspherical surface, and a Fresnel surface.

6. A projection type liquid crystal display device comprising:

a light source for emitting light;

TOP SECRET

a liquid crystal display element for optically modulating incident light; and

a projection lens for projecting the light modulated by said liquid crystal display element,

wherein said liquid crystal display element comprises:

a liquid crystal layer;

a pixel electrode portion having a plurality of pixel apertures for transmitting light; and

at least one microlens array having a plurality of microlenses arranged in a two-dimensional form on at least one of a light incident side and a light emergent side of said liquid crystal layer corresponding to said pixel apertures, and

wherein each of said microlenses comprises:

a light-collecting lens having at least one lens surface in the optical axis direction for collecting incident light toward corresponding one of said pixel aperture; and

a field lens having at least one lens surface in the optical axis direction so that the focal position thereof substantially coincides with the principal point of said light-collecting lens.

10045326-140901